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*Indian Standard*

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# SPECIFICATION FOR COLOUR AND STAR MATCHES IN BOXES

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**BUREAU OF INDIAN STANDARDS**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# Indian Standard

## SPECIFICATION FOR COLOUR AND STAR MATCHES IN BOXES

### 0. FOREWORD

**0.1** This Indian Standard was adopted by the Bureau of Indian Standards on 30 October 1987, after the draft finalized by the Explosives and Pyrotechnics Sectional Committee had been approved by the Chemical Division Council.

**0.2** The colour and star matches are one of the pyrotechnic materials used for the purpose of entertainment. Colour matches are also known as Bengal matches. The production of colour and star matches in this country is confined to small scale and cottage industries.

**0.3** The colour and star matches are similar to safety matches (*see IS : 2653-1980\**) with regard

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\*Specification for safety matches in boxes (*first revision*).

to the process of ignition by striking on the friction surface of the box. They are made up of the initiator tip and the pyrotechnic composition body. They burn with brilliant colour light in case of colour matches and sparks with light in case of star matches.

**0.4** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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\*Rules for rounding off numerical values (*revised*).

### 1. SCOPE

**1.1** This standard prescribes the requirements and methods of sampling and test for colour and star matches in boxes.

### 2. TERMINOLOGY

**2.0** For the purpose of this standard, the following definitions shall apply.

**2.1 Colour or Star Match Box** — The container in which colour or star matches are packed and reach the consumer. It consists of an outer part carrying the striking surface within which slides a drawer containing the match sticks.

**2.2 Colour Match** — The colour matches shall consist of an initiator tip, and a linear body of the pyrotechnic composition. They shall burn with brilliant colours.

**2.3 Star Match** — The star matches shall consist of an initiator tip, and a linear body of the pyrotechnic composition. They shall burn with brilliant light and sparks.

**2.4 Initiator Tip** — The first element of the pyrotechnic layer of the colour or star match normally contains a small amount of potassium chlorate based primary explosive which flames on the application of friction on the side of the match box. It is at the non-holding tip of the colour or star match and it is from this tip that the fire propagates to the pyrotechnic composition.

**2.5 Spurting** — The occurrence of the shooting of violent and sharp flame tongues in a particular direction instead of uniform burning.

**2.6 Hot Particles** — The burnt out and glowing particles which follow from the core of the flame.

### 3. REQUIREMENTS

**3.1 Appearance** — The colour or star match box and sticks shall have a neat appearance.

**3.1.1** No match stick shall protrude out of the box.

**3.2 Colour or Star Match Boxes** — The drawer and the outer cover of the match box in which the drawer slides, shall be made of wood, cardboard or a suitable material as approved by the Statutory Authority. The material, of which the drawer is made, may be similar or different from that of the outer cover.

**3.3** The match box shall be capable of bearing, without damage, a minimum vertical load of 100 N ( 10 kgf approximately ) exerted gradually on its broad side when it is laid flat on a hard horizontal surface. Before applying the load, the match box shall be conditioned for one hour at a temperature of  $27 \pm 2^{\circ}\text{C}$  and relative humidity of  $65 \pm 5$  percent. The match box shall also be capable of bearing without damage, a load of 50 N ( 5 kgf approximately ) after it is conditioned, as prescribed, for damp-proof test in B-6.

**3.4 Splints** — The splints used for making colour match sticks shall conform to IS : 10374-1982\*.

**3.4.1 Length of the Splints** — The minimum length of colour or star match splints shall be 42 mm.

**3.5 Initiator Tip** — The initiator tip shall have reasonably enough sensitivity for initiation by friction. It shall be firmly attached to the stick and the pyrotechnic train. It shall be nearly hemi-spherical in shape and shall initiate and transfer heat and fire uniformly to the pyrotechnic train.

**3.6 Pyrotechnic Composition** — The pyrotechnic composition shall have the following requirements.

**3.6.1** The chemicals generally used in these compositions are given in Appendix A.

**3.6.2** The length of the pyrotechnic composition shall be not more than 40 percent of the total length of the stick.

**3.6.3** The pyrotechnic composition shall have a cylindrical shape and a uniform diameter throughout the lengths and shall be not more than 2.5 times the thickness of the splint.

**3.6.4** The mass of the total pyrotechnic composition including the initiator tip and the body for colour and star matches shall be not more than  $0.7 \pm 0.1$  g and  $0.9 \pm 0.1$  g respectively, when tested as per the method given in B-7.

**3.6.5** The burning of the composition shall be uniform and smooth. There shall only be a controlled fall of hot particles. There shall be no spouting.

**3.7 Friction Surface** — The friction surface shall be on two narrower sides of the outer cover of the colour or star match box. It shall terminate at 2 to 3 mm from each edge of the narrower sides of the box and it shall not appear on the inner side of the box.

### 3.8 Defective Match Boxes

**3.8.1 Broken and Crushed** — The broken and crushed boxes in the test sample shall not exceed 5 percent.

**3.8.2 Loosely-fitted boxes** in the test sample shall not exceed one percent when tested as specified in 3.8.2.1.

**3.8.2.1 Procedure** — Remove the band roll from the box and hold it vertically. Watch whenever the inner drawer falls out of the box itself. Count the boxes in which the inner drawers fall as loosely fitted boxes.

**3.9 Unserviceable Sticks** — There shall be no unserviceable sticks in colour or star match box. The sticks which are considered as unserviceable are classified below.

**3.9.1 Distorted Shapes** — The initiator tip and the pyrotechnic composition shall be considered distorted when there are pronounced abnormalities in their shapes and surfaces, specially when they carry sharply defined peaks.

**3.9.2 Fractured Bodies** — The initiator and/or pyrotechnic composition shall be considered to be fractured when their surface is broken or cracked.

**3.9.3 Double** — Two initiators and/or pyrotechnic compositions fused together are termed as doubles.

**3.9.4 Broken Stick** — A stick is considered to be broken if the length of the stick is less than that specified and/or if the wooden part is cracked.

**3.9.5 Stick which Breaks on Striking** — The stick which breaks when struck against the friction surface.

**NOTE** — In case of dispute, the test prescribed in B-4 shall be carried out for deciding whether a colour or star match is serviceable or not.

**3.9.6 Blank** — A stick without either the initiator or the pyrotechnic composition, or both shall be termed as a blank.

**3.9.7 Partial Blank** — A stick having damaged initiator and/or pyrotechnic composition shall be considered as partial blank.

### 3.10 Number of Sticks

**3.10.1** A box shall contain 10 colour or star match sticks.

**3.10.1.1** So far as the tolerances, minimum of average number of match sticks and sample sizes for counting the number of match sticks are concerned, the necessary provisions of the standards of Weights and Measures ( Packaged Commodities ) Rules 1977 are applicable.

**3.11** The colour or star match stick shall burn for at least 5 s when ignited in a draught free atmosphere.

### 3.12 Performance Requirements

**3.12.1** The colour or star matches shall also comply with the performance requirements given in Table 1, when tested according to the test methods prescribed in Appendix B. Reference to relevant clauses of Appendix B is given in col 4 of Table 1.

\*Specification for wooden splints for safety matches.

**TABLE 1 PERFORMANCE REQUIREMENTS OF COLOUR OR STAR MATCHES IN BOXES**  
( Clause 3.12.1 )

SL No.	CHARACTERISTIC	REQUIREMENT	METHOD OF TEST, REFERENCE TO CLAUSE NO. IN APPENDIX B
(1)	(2)	(3)	(4)
i)	Safety	To pass test	B-1
ii)	Ignition below 170°C	To pass test	B-2
iii)	Ignition under impact	To pass test	B-3
iv)	Burning quality-defects percentage, Max	10	B-4
v)	Wearing strength of friction surface	To pass test	B-5
vi)	Damp-proofness, percentage, Min	70	B-6
vii)	Mass of pyrotechnic composition per stick (g)		B-7
a)	Colour	0.7 ± 0.1	
b)	Star	0.9 ± 0.1	

#### 4. PACKING AND MARKING

**4.1 Packing** — Twelve colour or star match boxes shall be wrapped in a suitable paper which shall be securely pasted or glued to make a tight packet, usually called 'dozen packet'. Twelve such packets may be wrapped in a suitable paper which shall be securely pasted or glued to make another tight intermediate packet usually called 'gross-packet'. 60 dozen packets or equivalent number of intermediate gross packets containing 60 dozen packets shall be packed using waterproof (*see IS : 1398-1982\**) which shall be securely pasted or glued to make a tight carton or bundle.

#### 4.2 Marking

**4.2.1** The colour or star match box, the packet and the carton shall have a label affixed to each one of them indicating the following details:

- a) *Match-Box* — Name and/or registered trade-mark, of the manufacturer and the number of match sticks.
- b) *Packet* — Name and/or registered trademark of the manufacturer, month and year of production, number of match boxes and number of match sticks in each box.
- c) *Carton or Bundle* — Name and/or registered trade-mark, of the manufacturer, date of manufacture and number of match boxes in a carton.

\*Specification for packing paper, water-proof, bitumen laminated (*second revision*).

**4.2.2** In addition to the above, the following cautionary note shall also conspicuously appear on the wrapper.

'FLAMMABLE MATERIAL — EMITS SHOWER OF SPARKS. USE UNDER ADULT SUPERVISION. HOLD WITH ARMS EXTENDED AWAY FROM THE BODY. LIGHT BY STRIKING THE INITIATOR TIP ON THE FRICTION SURFACE OF MATCH BOX'.

**4.2.3** The match boxes may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act 1986 and the Rules and Regulations made thereunder. The Standard Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well defined system of inspection, testing and quality control which is devised and supervised by BIS and operated by the producer. Standard marked products are also continuously checked by BIS for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

#### 5. SAMPLING

**5.1 Lot** — All the material of the same brand in a single batch produced in the same manufacturing unit shall constitute a lot.

**5.1.1** Samples shall be tested from each lot for ascertaining the conformity of the lot to the requirements of this specification. The number of cartons to be selected from a lot shall depend upon the size of the lot and shall be in accordance with Table 2.

**TABLE 2 NUMBER OF CARTONS TO BE SELECTED FROM A LOT**

LOT SIZE (CARTONS)	NUMBER OF CARTONS TO BE SELECTED
<i>N</i>	<i>n</i>
(1)	(2)
3 to 25	3
26 , , 50	4
51 , , 100	5
101 , , 150	6
151 and above	7

**5.1.2** These cartons shall be selected at random from the lot and for this purpose, random number tables shall be used. In case such tables are not available, the procedure given below shall be adopted.

**5.1.2.1** Starting from any carton in the lot, count them as 1,2,3, etc up to *r* and so on in one order. Every *r*th carton thus counted shall be withdrawn, where *r* is the integral part of *N/n* (*N* being the lot size and *n* the number of cartons to be selected ).

**5.1.3** From each of cartons selected in **5.1.1**, select at random a certain number of dozen packets depending upon the size of the carton, in accordance with Table 3.

**TABLE 3 NUMBER OF DOZEN PACKETS TO BE SELECTED FROM A CARTON**

NUMBER OF DOZEN PACKETS IN THE CARTON	NUMBER OF DOZEN PACKETS TO BE SELECTED
(1)	(2)
12	3
60	4
120	5

**5.1.3.1** The packets from the cartons shall also be selected at random and to ensure the randomness of selection, random number tables or the procedure given in **5.1.2.1** shall be used.

**5.1.3.2 Test sample** — Open each of the dozen packets in **5.1.3** and take out at random 4 match boxes from each of the packets. The boxes thus selected from the packets shall constitute a test sample. These boxes shall then be divided at random into two sets of equal number of boxes. One set shall be for the purchaser and other set shall be for referee sample. The referee sample shall bear the seals of both the purchaser and the supplier and shall be kept at a place agreed to between the two. The referee sample shall be tested in case of dispute only.

## 5.2 Number of Tests and Criteria for Conformity

**5.2.1** All the match boxes in a test sample shall be examined for the requirements given in **3.1**, **3.1.1**, **3.2**, **3.3**, **3.7**, **3.8.1** and **3.8.2**.

**5.2.1.1** The lot shall be considered as satisfactory in respect of these requirements, if the test sample of match boxes satisfies each one of these requirements.

**5.2.2** From the match boxes in the test sample, select four boxes at random. Pool the match sticks from all the four boxes together and taking the requisite number of match sticks at random from this pool of match sticks, carry out the tests as prescribed in **B-1** to **B-4** [ ( see also Table 1, items (i) to (iv) ].

**5.2.3** From the remaining match boxes of the test sample, select at random five boxes. Test each of the boxes for wearing strength of the friction surface according to **B-5.1** [ see also Table 1, item (v) ].

**5.2.3.1** The lot shall be considered satisfactory if each of the five match boxes pass the test.

**5.2.4** From the remaining match boxes of the test sample, select at random five match boxes and carry out the test for damp-proofness as given in **B-6** [ see also Table 1, item (vi) ].

**5.2.4.1** The lot shall be considered as satisfactory in regard to this requirement if the test result satisfies the requirements given in Table 1.

**5.2.5** From the remaining match boxes of test sample, select at random four boxes. Pool the match sticks of these four boxes together.

The lot shall be considered as satisfactory, if the total number of unserviceable match sticks does not exceed five percent ( see **3.9** ).

**5.2.5.1** Take at random 10 match sticks from the pool and test for the requirement as given in **3.4** and **3.4.1**.

The lot shall be considered as satisfactory if each of the 10 match sticks is found satisfactory.

**5.3 Criteria for Conformity** — The lot shall be declared as conforming to the requirements of this specification, if the different test results as obtained in **5.2.1** to **5.2.3** meet the corresponding requirements given in the standard.

## APPENDIX A

( Clause 3.6.1 )

### MAJOR CHEMICALS THAT CONSTITUTE THE INITIATOR, PYROTECHNIC COMPOSITION AND FRICTION SURFACE

<i>Colour Match</i>	<i>Colour Match</i>	<i>Star Match</i>
1. Potassium chlorate	11. Rhodamine dye powder	1. Barium nitrate
2. Barium nitrate	12. Turpentine oil	2. Dextrin
3. Strontium nitrate	13. Dextrin	3. Aluminium powder (Pyro grade)
4. Lamp black	14. Alumininm powder	4. Iron powder
5. Shellac	15. Antimony sulphide	5. Gum accacia/gum arabic
6. Sulphur	16. Gum acacia	
7. Zinc oxide	17. Varnish	
8. Glass powder	18. Tapioca flour	
9. Animal glue	19. Red phosphorous	
10. Potassium dichromate		

The types of paper used in this industry are mainly blue match, label and packing.

## APPENDIX B

( Clauses 3.6.4, and 3.12.1; and Table 1 )

### METHODS OF TEST FOR COLOUR OR STAR MATCHES IN BOXES

#### B-1. SAFETY

**B-1.0 Principle** — The test is carried out by striking the match sticks against the flint paper.

**B-1.1** Take 10 match sticks from the selected boxes of the sample and strike over a sheet of flint paper of IS Grit Number 120 (3/0) [ conforming to IS : 715 ( Part 1 )-1976\* ]. The average length of stroke on the flint shall be about 50 mm.

**B-1.1.1** The sample shall be taken to have passed the test if none of the match sticks catches fire.

**NOTE** — In case of dispute, the match sticks shall be conditioned at a temperature of  $27 \pm 2^{\circ}\text{C}$  and the relative humidity of  $65 \pm 5$  percent for one hour ( see IS : 196-1966† ) before carrying out the test for safety.

#### B-2. IGNITION BELOW 170°C

**B-2.0 Principle** — The test is carried out by placing the match sticks in an oven maintained at  $170^{\circ}\text{C}$  and examined for ignition.

#### B-2.1 Apparatus

**B-2.1.1 Oven** — Oven to be used shall be air circulated, thermostatically controlled electric oven of which electrical elements shall be totally enclosed.

\*Specification for coated abrasives, Part 1 General application ( third revision ).

†Specification for atmospheric conditions for testing ( revised ).

**B-2.1.2 Thermometer** — To read up to  $250^{\circ}\text{C}$ .

**B-2.1.3 Wooden Block** — It shall be 30 mm thick and 50 mm square, having a hole of 10 mm diameter to a depth of 25 mm in the centre to serve as a receptacle to hold the sticks.

**B-2.2 Procedure** — Take 10 normal match sticks ready for use from the selected match boxes of the test sample and place them with the heads up in the receptacle of the wooden block. Place the block in the centre of the oven. Suspend the thermometer in such a way that its bulb is in level with the match heads and is at a distance of about 50 mm from the match heads. Thermometer bulb shall be covered with a wire mesh. Close the door of the oven and raise its temperature to  $140^{\circ}\text{C}$ . After this, raise the temperature uniformly at a rate of approximately  $3^{\circ}\text{C}$  per minute until a temperature of  $170^{\circ}\text{C}$  is reached.

**B-2.2.1** The sample shall be taken to have passed the test if none of the match sticks catches fire.

#### B-3. IGNITION UNDER IMPACT

**B-3.0 Principle** — The test is carried out by striking the match sticks with a hammer of 170 g and examined for ignition.

**B-3.1 Apparatus** — The apparatus shall be assembled as shown in Fig. 1.

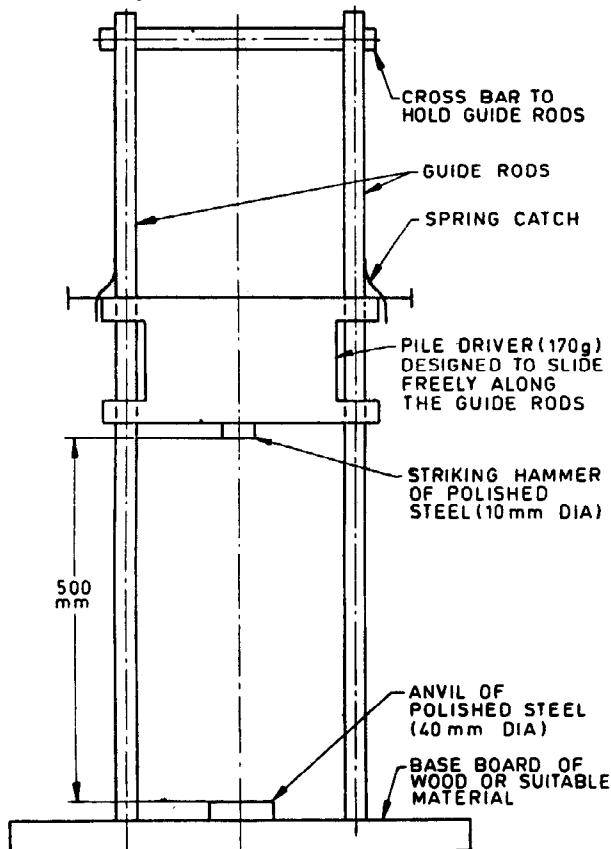


FIG. 1 APPARATUS FOR IMPACT TEST

**B-3.2 Procedure** — Take 10 match sticks from the selected match boxes of the test sample and test each match stick separately. Place the stick on the anvil of polished steel in such a way that the stick is horizontal and the head is at its centre. Drop the striking hammer by releasing the spring catch. Observe whether the head catches fire under this impact.

**B-3.2.1** The sample shall be taken to have passed the test if none of the match sticks catches fire.

#### B-4. BURNING QUALITY — DEFECTS

**B-4.0 Principle** — The test is carried out by striking the match sticks against the friction surface and examining for spouting, if any.

**B-4.1 Procedure** — Take 100 match sticks at random from the selected match boxes of the test sample and strike against the friction surface and observe the number of heads which spurt out while burning. The match head particles shall not fly when the head is struck. During the test, the matches shall be held over a white sheet of paper at a distance of about 70 cm above it. Any burn marks resulting from the dropping of hot ash or particles shall be noted.

**B-4.1.1 Mode of Striking** — The match stick shall be held firmly between front finger and

thumb and struck downwards, with a minimum pressure necessary to ensure ignition ( see Fig. 2 ).

#### B-5. WEARING STRENGTH OF FRICTION SURFACE

**B-5.0 Principle** — The test is carried out by striking the match sticks against the friction surface.

**B-5.1** Take 5 match boxes from the test sample. Strike all the match sticks in the box one by one on any one friction surface side of the box ( see B-4.1.1 ). Repeat the test for remaining boxes also. The sample shall be taken to have passed this test if that one friction surface side is sufficient to ignite all the match sticks of the same box. The friction surface shall be suitably used so that the entire area of one side is utilized in the test. During this test, the friction surface shall not catch fire following the striking of the match sticks.

**NOTE** — In case of dispute, the match sticks shall be conditioned at a temperature of  $27 \pm 2^{\circ}\text{C}$  and relative humidity of  $65 \pm 5$  percent for one hour ( see IS : 196-1966\* ) before carrying out the test for wearing strength. The cover of the match boxes shall be removed during conditioning.

\*Specification for atmospheric conditions for testing (revised).

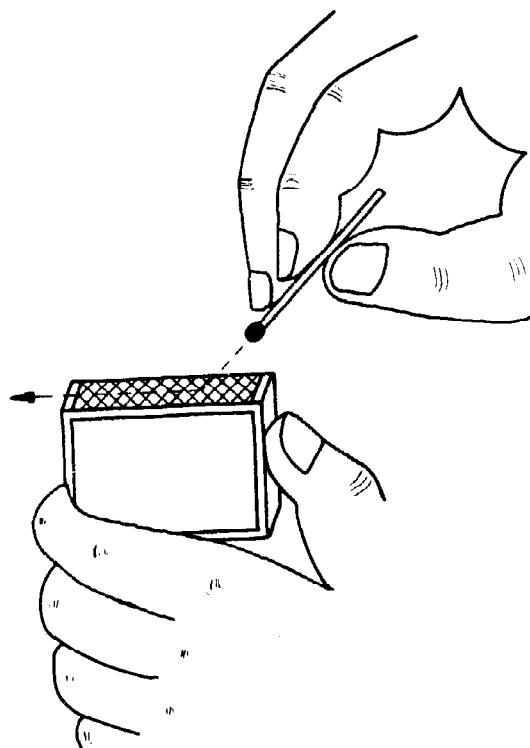


FIG. 2 MODE OF STRIKING

## B-6. DAMP-PROOFNESS

**B-6.0 Principle** — The test is carried out by keeping the match boxes in a desiccator containing water for 24 hours and examining for their burning quality.

### B-6.1 Apparatus

**B-6.1.1 Desiccator** — Inside diameter of about 250 mm and overall height of 303 mm with a plate inside (*see IS : 6128-1971\**). The desiccator plate shall be made of porcelain having 5 mm thickness or aluminium having 2 mm thickness consisting of 162 holes of diameter 5 mm each and a central hole of diameter 23 mm.

**B-6.2 Sample** — Make 5 boxes each containing 50 serviceable sticks.

**B-6.3 Procedure** — The test shall be carried out in an environment with a temperature of  $27 \pm 2^{\circ}\text{C}$ .

\*Specification for desiccators.

The match sticks shall be conditioned at a temperature of  $27 \pm 2^{\circ}\text{C}$  and relative humidity of  $65 \pm 5$  percent for 6 hours. Sufficient amount of water shall be taken in the desiccator, so that the distance between the water surface and the bottom surface of porcelain plate is about 25 mm. Five match boxes (in accordance with B-6.2) shall be placed in the desiccator in a way that the head side of each match box is half open and each box rests on its edge with the friction surface vertical as well as heads up. This filling of desiccator with match boxes shall not take more than 2 minutes when it is again placed in the ambient conditions mentioned above. The match box shall be placed on the desiccator plate so that each match box is not closer than 15 mm to the walls of desiccator. The desiccator shall remain closed for 6 hours in the same ambient conditions (*see Fig. 3*). One match box at a time shall be taken out from desiccator and immedia-

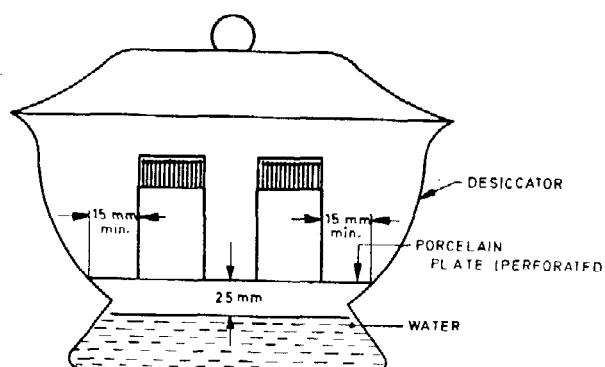


FIG. 3 CONDITIONING OF MATCHES IN DESICCATOR

tely each of its sticks, one by one, shall be struck against the friction surface for igniting. This shall be repeated with other boxes in desiccator. The desiccator shall be closed after taking out each match box and this testing shall take not more than 15 minutes in all. The number of match sticks which blink, fizz, do not ignite or whose heads fly off, shall be recorded.

**B-6.4 Calculations** — Percent of damp-proofness shall be calculated as follows:

Damp-proofness, percent

$$= \frac{(N - n) 100}{N}$$

where

$N$  = total number of match sticks, taken for this test; and

$n$  = total number of match sticks which blink, fizz, do not ignite or whose heads fly off.

### **B-7. MASS OF PYROTECHNIC COMPOSITION OF COLOUR OR STAR MATCH**

**B-7.1** The mass of dipped chemicals of colour and star matches shall be determined by removing it from five match sticks mechanically and weighing it in a tared dish or glazed paper.

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